Claims

What is claimed is:

1. An optical demultiplexer for demultiplexing an optical signal having a plurality of channels at a predetermined channel spacing comprising:

demultiplexing means having a frequency spacing larger than the predetermined channel spacing for receiving the optical signal and for dividing the optical signal by wavelength into a plurality of wavelength streams broader than the predetermined channel spacing;

time domain demultiplexing means for receiving one of the plurality of wavelength streams and for dividing the one of the plurality of wavelength streams into a plurality of time domain demultiplexed wavelength streams; and

optical filtering means for demultiplexing one of the plurality of time domain demultiplexed wavelength streams into a single channel.

2. The optical demultiplexer as defined in claim 1 further comprising splitting means for splitting the optical signal into at least two sub-signals before launching one of the sub-signals into the demultiplexing means.

3. The optical demultiplexer as defined in claim 2 further comprising clock recovery means for obtaining a clock signal from the one of the plurality of wavelength streams and for providing the clock signal to the time domain demultiplexing means for dividing the one of the plurality of wavelength streams into a plurality of time domain demultiplexed wavelength streams in dependence upon the clock signal.

4. The optical demultiplexer as defined in claim 3 comprising a plurality of time domain demultiplexing means and a plurality of optical filtering means, said plurality of time domain demultiplexing means for receiving the plurality of wavelength streams and for dividing the plurality of wavelength streams into a plurality of time domain demultiplexed wavelength streams, and each of said plurality of optical filtering means for demultiplexing each of the plurality of time domain demultiplexed wavelength streams into a single channel.

5. The optical demultiplexer as defined in claim 3 wherein a frequency spacing of the demultiplexing means is one of an integer multiple and a non-integer multiple of the predetermined channel spacing.

6. The optical demultiplexer as defined in claim 5 wherein the integer multiple is two.

7. The optical demultiplexer as defined in claim 6 wherein the demultiplexing means demultiplexes the optical signal according to a standardized International Telecommunications Union (ITU) frequency grid.

8. The optical demultiplexer as defined in claim 6 wherein the predetermined channel spacing is a frequency spacing according to a standardized International Telecommunications Union (ITU) frequency grid.

9. The optical demultiplexer as defined in claim 6 wherein the time domain demultiplexing means is one of a lithium niobate ($LiNbO_3$) modulator and a semiconductor optical amplifier switch.

10. The optical demultiplexer as defined in claim 9 wherein the optical filtering means is a band-pass filter.

11. The optical demultiplexer as defined in claim 10 wherein the optical signal has a return to zero (RZ) modulation format.

12. The optical demultiplexer as defined in claim 5 wherein a sum of bit-rates of the plurality of time domain demultiplexed wavelength streams is equal to a bit-rate of the one of the plurality of wavelength streams.

13. An optical demultiplexer for demultiplexing a multiplexed N channel optical signal comprising:

splitting means for splitting the multiplexed N channel optical signal into a plurality of multiplexed N channel optical sub-signals;

first demultiplexing means for coarse wavelength demultiplexing the plurality of multiplexed N channel optical sub-signals into M sub-signals;

second demultiplexing means for time demultiplexing the M sub-signals into R sub-signals; and

third demultiplexing means for wavelength demultiplexing the R sub-signals into N single channels.

14. The optical demultiplexer as defined in claim 13 further comprising clock recovery means for extracting a clock signal from the M sub-signals for demultiplexing the M sub-signals into the R sub-signals in dependence upon the clock signal.

15. A method for demultiplexing a high bit-rate signal on a dense optical grid comprising the steps of:

providing the high bit-rate signal including a plurality of wavelength channels at a predetermined channel spacing to a coarse wavelength demultiplexer;

performing a coarse wavelength demultiplexing for dividing the high bit-rate signal into wavelength streams broader than the predetermined channel spacing;

performing an optical time domain demultiplexing for dividing at least one of the wavelength streams into a plurality of time demultiplexed streams; and

filtering at least one time demultiplexed stream through a wavelength filter for obtaining at least one individual wavelength channel.

16. The method as defined in claim 15 further comprising the step of identifying a timing signal from the wavelength streams for performing an optical time domain demultiplexing for at least one of the wavelength streams in dependence upon the timing signal.

17. The method as defined in claim 15 further comprising the step of initially splitting the high bit-rate signal into at least two streams and providing each stream into a separate coarse wavelength demultiplexer of different but overlapping wavelength ranges.